

Rio Grande Silvery Minnow Rescue and Salvage – 2006

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New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque, NM 87113

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Executive Summary

This report documents efforts during 2006 to reduce the mortality of post-larval Rio Grande silvery minnows (*Hybognathus amarus*, silvery minnow) when flow in the Middle Rio Grande became intermittent and it discusses the effectiveness of those efforts using the limit of incidental take as the standard of performance. The limit of incidental take was defined in the March 17, 2003 Biological Opinion (U. S. Fish and Wildlife Service, 2003; March 17, 2003 BO) and modified on August 15, 2005 (U. S. Fish and Wildlife Service, 2005a) and June 15, 2006 (U. S. Fish and Wildlife Service, 2006a). As amended, the incidental take is now estimated annually for the period April 1 through March 30 using a formula that incorporates monitoring data from October of the previous year, habitat conditions during the spawn (spring runoff), and augmentation. Estimates of incidental take are derived from surveys in which observed mortality is multiplied by 50, based on the assumption that the probability of observing a single mortality is 0.02. The June 15, 2006 amendment also specifies that the incidental take statement applies to silvery minnows larger than 30 mm standard length or approximately 35 mm total length. The amended incidental take limit that applied to 2006 was 13,296,774 and is equivalent to 265,935 silvery minnows observed dead, restricting observations to silvery minnows larger than 30 mm standard length or approximately 35 mm total length.

Silvery minnow rescue operations generally progressed in synchrony with river recession over the course of the 2006 irrigation season, involving both floodplain and main channel habitats. Rescue operations in main channel habitats were given priority over rescue operations in floodplain habitats. Ultimately, 26.0 miles of the main channel of the Middle Rio Grande were dried. Flow became discontinuous in a 16.5 mile main channel segment of the Socorro Reach of the Middle Rio Grande, located between Neil Cupp (approximately 4.0 miles upstream of U. S. 380) and the south boundary of Bosque del Apache Wildlife Refuge, during the 2006 irrigation season. Flow became discontinuous in a 9.5 mile segment of the main channel of the Isleta Reach of the Middle Rio Grande, located between points approximately 0.5 miles upstream of N. M. Highway 49 (at Los Lunas) and the Peralta Wasteway (approximately 3.0 miles upstream of N. M. Highway 6 (at Belen).

Rescue operations were conducted in 104 miles of the Middle Rio Grande over the course of 52 days during the 2006 irrigation season. Rescue operations were restricted to lateral main channel pools during the period of March 29, 2006 to May 8, 2006. Rescue operations associated with main channel drying began on May 21, 2006 and continued through May 23, 2006 when a 4.7 mile reach of the Rio Grande went dry upstream of the south boundary of Bosque del Apache Wildlife Refuge. Rescue operations associated with main channel drying resumed on June 15, 2006 and continued intermittently through July 26, 2006. There was a hiatus in rescue operations from July 27, 2006 through September 19, 2006 when flow in the Middle Rio Grande became continuous due to heavy runoff associated with monsoonal rains. Rescue operations associated with main channel drying began again on September 20 and continued nearly continuously through October 7, 2006. Rescue operations continued in floodplain habitats over the course of a few days beyond October 7, 2006 (ending on October 30, 2006). An estimated total of 69,889 silvery minnows, mostly Age I fish, was captured in the isolated pools of the Middle Rio Grande; 69,226 (99.05%) came from active main channel habitats and 663 (0.95%) came from flood plain habitats. Of these, 99.98 percent were transported alive to perennial flowing sections of the Rio Grande, in the Albuquerque, Isleta and San Acacia reaches, where they were released.

The death of 2,400 silvery minnows was attributed to water operations in the Middle Rio Grande during the 2006 irrigation season. This level of incidental take was within legal limitations established under the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003), as modified on August 15, 2005 (U. S. Fish and Wildlife Service, 2005a) and June 15, 2006 (U. S. Fish and Wildlife Service, 2006a). Silvery minnow mortality that occurred in portions of river that were rewetted due to forces outside of the operations of the Action Agencies was not considered to be incidental take under the March 17, 2003 BO

(U. S. Fish and Wildlife Service, 2003). Silvery minnow mortality that exhibited advanced clinical signs of poor health (e.g., advanced hemorrhagic lesions) was not considered to be incidental take. Likewise, silvery minnow mortality that occurred outside of the main river channel was not considered to be incidental take under the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003).

Introduction

Until the 1950s, the Rio Grande silvery minnow (*Hybognathus amarus*, silvery minnow) was distributed throughout many of the larger order streams of the Rio Grande Basin upstream of Brownsville, Texas to points north in New Mexico primarily below 5,500 ft elevation (1,676 m). This elevation coincides with the approximate vicinities of Abiquiu on the Chama River, Velarde on the Rio Grande, and Santa Rosa on the Pecos River. Today, absent from much of its historic range, the silvery minnow is restricted to a variably perennial reach of the Rio Grande in New Mexico, from the vicinity of Bernalillo downstream to the headwaters of Elephant Butte Reservoir, a distance that fluctuates as the size of the pool of water in storage in Elephant Butte Reservoir changes, but that approximates 150 river miles (241 km). Most descriptions of the contemporary range of silvery minnow cite the entire reach of the Rio Grande between Cochiti Dam and Elephant Butte Reservoir. However, that assertion cannot be made with certainty. The species' status in the Rio Grande between Cochiti Dam and Angostura Irrigation Diversion Dam is unknown because that reach of river has not been surveyed in recent years.

The silvery minnow is currently listed as endangered by the State of New Mexico, having first been listed May 25, 1979 as an endangered endemic population of the Mississippi silvery minnow (*Hybognathus nuchalis*; New Mexico Department of Game and Fish, 1988). The species is also listed as endangered by Texas (Sections 65.171 - 65.184 of Title 31 T.A.C.) and the Republic of Mexico (Secretaria de Desarrollo Social, 1994). On July 20, 1994, the U. S. Fish and Wildlife Service (Service) published a final rule to list the silvery minnow as a Federal endangered species with proposed critical habitat (Federal Register, 1994). In 2003, the Service designated critical habitat for the silvery minnow in the Middle Rio Grande. The designation extends from Cochiti Dam downstream about 157 mi (252 km) to the utility line crossing the Rio Grande in Socorro County. This location is at 4,450 feet of elevation (1,356 m), corresponding to the elevation of the spillway crest for Elephant Butte Dam. The lateral limits (width) of critical habitat extend between the existing levees or, in areas without levees, the riparian zone, extending 300 feet (91.4 m) laterally from each side of the bankfull stage of the Middle Rio Grande. Portions of the Pueblos of Santo Domingo, Santa Ana, Sandia, and Isleta fall within the broader area designated as critical habitat, but the Pueblos are specifically excluded from the critical habitat designation.

On March 17, 2003, the Service issued a Biological Opinion on the effects of actions associated with the, "Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico," (U. S. Fish and Wildlife Service, 2003; March 17, 2003 BO). The consultation involved two federal agencies, U. S. Bureau of Reclamation and the Army Corps of Engineers, and two non-federal entities. The Service concluded that water operations and river maintenance activities in the Middle Rio Grande, as proposed (Reclamation and Corps, 2003), were likely to jeopardize the continued existence of the silvery minnow (along with the southwestern willow flycatcher (*Empidonax traillii eximius*; flycatcher)) and adversely modify critical habitat of the silvery minnow (U. S. Fish and Wildlife Service, 2003). The March 17, 2003 BO describes a Reasonable and Prudent Alternative, Reasonable and Prudent Measures, and Conservation Measures that serve in part to secure baseline conditions for the silvery minnow and flycatcher. As a part of the March 17, 2003 BO, the Service established the annual incidental take limit for silvery minnows. That limit was amended on August 15, 2005 (U. S. Fish and Wildlife Service, 2005a) and June 15, 2006 (U. S. Fish and Wildlife Service, 2006a), incorporating a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Action agencies are apprised of the limit for incidental take by April 1 each year. Estimates of incidental take are derived from surveys in which observed mortality is multiplied by 50, based on the assumption that the probability of observing a single mortality is 0.02. The August 15, 2005 amendment also specified that the incidental take statement applies to silvery minnow 30 mm standard length or approximately 35 mm total length. The amended incidental take limit for the 2006 irrigation season of 13,296,774 is equivalent to 265,935 silvery

minnows that are observed dead. The amended incidental take statement clarified how dead silvery minnows are measured. As amended, take applies to silvery minnows larger than 30 mm standard length or approximately 35 mm total length.

This report documents efforts during 2006 to reduce the mortality of post-larval Rio Grande silvery minnows when flow in the Middle Rio Grande became intermittent and it discusses the effectiveness of those efforts using the permitted limit of incidental take defined in the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003) and subsequently amended on August 15, 2005 (U. S. Fish and Wildlife Service, 2005a) and June 15, 2006 (U. S. Fish and Wildlife Service, 2006a), as the standard of performance.

By convention, the “Middle Rio Grande” is defined as the area of the Rio Chama watershed and the Rio Grande, including all tributaries, from the Colorado/New Mexico state line downstream to the elevation of the spillway crest of the Elephant Butte Dam (4450 feet mean Sea Level). The Middle Rio Grande below Cochiti Dam is further designated by four divisions/reaches defined by locations of mainstream irrigation diversion dams. The Cochiti Reach extends from Cochiti Dam to Angostura Diversion Dam. The reach from Angostura Diversion Dam to Isleta Diversion Dam is called the Albuquerque Reach. The Isleta Division/Reach is bounded upstream by Isleta Diversion Dam and downstream by San Acacia Diversion Dam. Finally, the reach below San Acacia Diversion Dam to the headwaters of Elephant Butte Reservoir is the Socorro Division/Reach.

Methods

Rescue of Silvery Minnows

Using beach seines of various sizes, fish were collected from pools that formed as flow in the Middle Rio Grande becomes discontinuous. Prior to handling silvery minnows, personnel washed their hands to remove the residue of lotions (e.g., suntan lotions and mosquito repellent). Fish were handled with care using wetted hands. All captured fish were identified to the species level and silvery minnows were quickly culled from collections. Silvery minnows that exhibited advanced clinical signs of poor health (e.g., lethargy and hemorrhagic lesions) were not salvaged. Taxonomic keys for fish identification in the Middle Rio Grande appear in Sublette et al 1990; phylogenetic classification followed Nelson et al. (2004). Captured silvery minnows were placed into five gallon buckets filled with river water and subsequently transferred to transport tanks or plastic bags for transport to a release site. Tanks were employed to transport silvery minnows in instances when their use was logistically possible and when it was impractical to put fish in bags; bags were used to transport silvery minnows in antithetical situations.

Transport tanks equipped with water-tight lids were filled with water to near capacity to reduce sloshing and vibration within the tank during fish transport. Every effort was made to fill transport tanks with water that was relatively free of pollutants (river water will be avoided when possible). Bags were filled with water to approximately 2/3 capacity (approximately 3 liters, approximately equivalent to 0.8 gallons); the remaining volume of the bag was inflated with pure oxygen and its opening sealed to prevent the loss of the bag's contents. Rock salt (NaCl) was added to water in hauling vessels at the rate of 18.9 grams/gallon (to achieve a 0.5 % NaCl solution), and Stress Coat was added at the rate of 0.26 ml/L (1 ml/gallon).

Pure oxygen was supplied to transport tanks through micro-bubble oxygen diffusers. The flow of oxygen was adjusted with varying water temperatures and loading rates of fish to maintain dissolved oxygen levels at or above 8.0 mg/L. Ice was added slowly to the tanks to maintain water temperature approximately 5° C lower than the river. Care was taken to insure that densities of silvery minnows in transport vessels would not contribute to an unusually high rate of silvery minnow mortality. Bags with fish were inflated with oxygen as soon as practical. Plastic bags containing silvery minnows were placed in ice chests. Ice was employed to maintain water temperatures in transport vessels at about 5° C lower than the river. At times, bags were cushioned with bubble wrap or other materials to reduce trauma to transported fish from impact and vibration associated with transport.

Rescued silvery minnows were transported to perennial portions of the Middle Rio Grande where live fish were released to the river. Generally, rescued silvery minnows were transported to the Albuquerque Reach where they were released, but occasionally rescued silvery minnows were transported and released at select locations in the Isleta and Socorro reaches when hydrologic conditions there insured perennial flow. Release of rescued fish was postponed until the rate of mortality of transported silvery minnows decreased to a barely detectable level. At times, rescued silvery minnows were subjected to a 0.75 percent solution of NaCl (i.e., half again the concentration prescribed for transport) for approximately 15 minutes prior to stocking to reduce the load of certain pathogens carried by the species (Hattingh et al. 1975). Lots¹ of fish that exhibited advanced clinical signs of poor health (e.g., lethargy and hemorrhagic lesions) were not released to perennial portions of the Middle Rio Grande. Silvery minnow mortality was not regarded as incidental take or transport loss if the apparent cause of silvery minnow death could be attributable to poor health at the time of capture. Prior to releasing healthier silvery minnows into the river, water in the transport tanks was tempered (by slowly² adding river water to the transport tanks) until it was within 1° C of the water temperature of the river at the release site. Bags of silvery minnows were placed in the river to equilibrate the temperature of the water in the bags to within 1° C of the water temperature of the river at the release site.

For each day that rescue operations were conducted, counts or estimates of the number of silvery minnows rescued were made by river reach. The number of silvery minnows rescued often precluded their quantification by absolute counts. It was often necessary to estimate the number of silvery minnows rescued by counting the number of silvery minnows in subsamples representative of the density of the total catch, and subsequently multiplying that count by the reciprocal of the subsample proportion of the total. Counts or estimates of silvery minnow transport loss were made and general stocking locations were noted.

Data was recorded on the form that appears in Appendix A: “RGSM Rescue – Daily Field Form.” Data regarding rescue operations pertain to a segment of aquatic habitat. The longitudinal limits of the sample segments are recorded to the nearest half (0.5) river mile and positioned laterally on the presumed thalweg. Northing and easting coordinates are associated in a one-to-one relationship with the center point of each half-mile coordinate. Accuracy in spatial geographic depictions of sample locations outside of the main river channel was achieved by algebraically adjusting the easting coordinate by a standard factor (e.g., ± 125 meters), depending on whether the sampling was conducted in the east or west floodplain. It is emphasized that the data presented in this report regarding the number of silvery minnows rescued are not derived from a random sample, and counts (or estimates) of silvery minnows rescued imperfectly reflect the abundance of silvery minnow populations.

In a separate study, hatchery-produced silvery minnows have been stocked into various reaches of the Middle Rio Grande. Each batch of the hatchery-produced silvery minnows was distinguished by a unique visible implant elastomer mark before being released. The location, condition, and fate of these marked silvery minnows were noted as they were encountered during rescue operations.

Determination of Incidental Take

Rio Grande silvery minnow (silvery minnow) mortality can occur with channel drying resulting from drought conditions, and conditions resulting from federal mediated water operations. In the recent past, intermittent conditions have existed in significant portions (e.g., up to 68.0 miles – approximately 45 percent of the silvery minnow’s contemporary range) of the river between Isleta Diversion Dam and Elephant Butte Reservoir that, without management intervention, would result in substantial silvery minnow mortality. Efforts to salvage silvery minnows from intermittent reaches of river are intended to reduce silvery minnow mortality that can occur with channel drying resulting from drought conditions. It

¹ A “lot” is defined as an aggregate unit of collection. A lot can be a bag or a tank of fish.

² Adjustment of water temperature was accomplished at the approximate rate of 1° C per 20 minutes.

will also reduce the probability that the mortality associated with water operations will exceed the limit for incidental take.

Silvery minnow rescue operations progressed in synchrony with river recession, with priority given to river reaches in which the death of silvery minnows due to federal water operations would be considered incidental take. Silvery minnow mortality that occurs as a result of federal water operations in the Middle Rio Grande is evaluated under limitations established in the March 17, 2003 Biological Opinion (BO, U.S. Fish and Wildlife Service, 2003) and as modified on June 15, 2006 (U. S. Fish and Wildlife Service, 2006a). As amended, the incidental take is now estimated annually using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Estimates of incidental take are derived from surveys in which observed mortality is multiplied by 50, based on the assumption that the probability of observing a single mortality is 0.02. The June 15, 2006 amendment also specifies that the incidental take statement applies to silvery minnows larger than 30 mm standard length³ or approximately 35 mm total length⁴. The amended incidental take limit that applies to 2006 is 13,296,774 and is equivalent to 265,935 silvery minnows observed dead, restricting observations to silvery minnows larger than 30 mm standard length or approximately 35 mm total length.

Incidental take of post embryonic silvery minnows is defined for two size classes, i.e., for those shorter or longer than 30 mm standard length or approximately 35 mm total length. All smaller sized post embryonic silvery minnows are presumed to be taken as a result of federal water operations when the river dries downstream of Isleta Diversion (U. S. Fish and Wildlife Service, 2003).

Determination of incidental take of the larger size class of post embryonic silvery minnows was conditional. Mortality of the larger sized post embryonic silvery minnows that occurs in portions of the river that are rewetted due to forces that are not directly or indirectly related to the operations of the Action Agencies was not considered to be incidental take under the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003). In contrast, rewetting of river reaches that were previously dried in violation of the BO was directly or indirectly related to the operations of the Action Agencies; in such instances, silvery minnow mortality (the larger sized post embryonic individuals) associated with subsequent drying was regarded as incidental take. Silvery minnow mortality, involving the larger sized post embryonic individuals, that occurs outside of the active river channel was generally not considered to be incidental take under the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003); the exception to this generalization involves areas outside of the active channel that are wetted as a consequence of federal water pumping operations (i.e., water pumped from the low flow conveyance channel in an effort to maintain specified flows in the river). Finally, the larger sized post embryonic silvery minnows that are “rescued” and that die in transit to relocation sites were not considered to be incidental take. Likewise silvery minnows that died and exhibited advanced clinical signs of poor health (e.g., lethargy and hemorrhagic lesions) were not considered to be incidental take.

A diurnal expansion-contraction cycle attends river recession. The rate and timing of this cycle varies with rates and timing of evaporation and transpiration. As such, the upstream extent of river recession generally fluctuates diurnally, sometimes by as much as a mile per day. This phenomenon generally serves to reduce mortality to silvery minnows by refreshing/replenishing the supply of water in isolated pools at the upstream terminus of river recession. However, silvery minnow mortality can attend any event of river contraction, including that associated with the diurnal expansion-contraction cycle. Such mortality is regarded as an indirect effect of water operations, i.e., an effect caused or induced by an action that is “reasonably certain to occur” (50 C.F.R §402.02). As such, silvery minnow mortality, involving the larger sized post embryonic individuals, that may occur in the proximity of the upstream

³ Standard length is defined as the distance from the anteriormost projection of the head to the hypural notch; the hypural notch is the point between the end of the body vertebrae and the beginning of the caudal fin, generally denoted as the crease in the caudal peduncle made by bending the caudal fin to one side or the other.

⁴ Total length is defined as the distance from the anteriormost projection of the head to the tip of the caudal fin when the lobes of the caudal fin are arranged to achieve the maximum length.

terminus of river recession and that occurs indirectly as a result of the diurnal expansion-contraction cycle was regarded as incidental take. In contrast, events of river expansion (i.e., river channel rewetting) that occur as a result of storm events are stochastic in nature and are usually short-lived. Generally, flows in the river retract quickly following a storm event and may result in silvery minnow mortality. However, such mortality cannot be said to be a direct or indirect effect of water operations.

Results

Rescue of Silvery Minnows

Silvery minnow rescue operations generally progressed in synchrony with river recession over the course of the 2006 irrigation season, involving both floodplain and main channel habitats. Rescue operations in main channel habitats were given priority over rescue operations in floodplain habitats. Ultimately, 26.0 miles of the main channel of the Middle Rio Grande were dried. Discontinuous main channel segments of the Socorro Reach of the Middle Rio Grande, totaling 16.5 miles and located generally between Neil Cupp (approximately 4.0 miles upstream of U. S. 380) and the south boundary of Bosque del Apache Wildlife Refuge, became dry during the 2006 irrigation season. Discontinuous main channel segments of the Isleta Reach of the Middle Rio Grande, totaling 9.5 miles and located generally between points approximately 0.5 miles upstream of N. M. Highway 49 (at Los Lunas) and the Peralta Wasteway (approximately 3.0 miles upstream of N. M. Highway 6 (at Belen), became dry during the 2006 irrigation season.

Rescue operations were conducted on 52 days during the 2006 irrigation season. Rescue operations were restricted to lateral main channel pools during the period of March 29, 2006 to May 8, 2006. Rescue operations associated with main channel drying began on May 21, 2006 and continued through May 23, 2006 when a 4.7 mile reach of the Rio Grande went dry upstream of the south boundary of Bosque del Apache Wildlife Refuge. Rescue operations associated with main channel drying resumed on June 15, 2006 and continued intermittently through July 26, 2006. There was a hiatus in rescue operations from July 27, 2006 through September 19, 2006 when flow in the Middle Rio Grande became continuous due to heavy runoff associated with monsoonal rains. Rescue operations began again on September 20 and continued nearly continuously through October 7, 2006. Rescue operations continued in floodplain habitats over the course of a few days beyond October 7, 2006.

An estimated total of 69,889 silvery minnows were captured in the isolated pools of the river, including main channel habitats and habitats in the floodplain (Tables 1-2, Figures 1-2). Most of these were *in situ* produced young-of-year and were not marked, indicating that they were not of immediate hatchery origin. Although vastly fewer than the number of silvery minnows rescued during the 2005 irrigation season (626,444; U. S. Fish and Wildlife Service, 2006b), this number of rescued silvery minnows greatly exceeds that rescued before 2005: 12,865 during 2004, 713 during 2003, 3,662 during 2002, and 240 during 2001 (U. S. Fish and Wildlife Service, 2005b; Smith and Basham 2003; Smith and Munoz 2002; Smith 2001). Of the silvery minnows rescued during 2006, 99.98 percent were transported alive to perennial flowing sections of the Rio Grande, in the Albuquerque, Isleta and Socorro reaches, where they were released (Tables 1 and 2).

The average daily longitudinal extent of aquatic habitat involved in rescue operations per day was 2.00 river miles (ranging from 0.25 – 6.0 river miles per day; standard deviation 1.644211). One or more river miles were rescued per reach on 35 of the days of rescue activities (approximately 67.3% of the total days of rescue; Figure 5). The rate at which silvery minnow rescue operations progressed was generally in synchrony with river recession over the course of the 2006 irrigation season, including in floodplain and main channel habitats. River recession occurred at or below the rate allowed in the March 17, 2003 BO; U. S. Fish and Wildlife Service, 2003), as modified on June 15, 2006 (U. S. Fish and Wildlife Service, 2006b; i.e., 8.0 miles/day).

Of the silvery minnows rescued during the 2006 irrigation season, an estimated 24,587(35.2%) of the estimated total number of silvery minnows rescued were captured in the Isleta Reach between points approximately 0.5 miles upstream of N. M. Highway 49 at Los Lunas, and the Peralta Wasteway (approximately 3.0 miles upstream of N. M. Highway 6 at Belen) (Table 1). An estimated total of 45,302 silver minnows were captured in the Socorro Reach generally between Neil Cupp (approximately 4.0 miles upstream of U. S. 380) and the south boundary of Bosque del Apache Wildlife Refuge, New Mexico (64.8% of the estimated total number of silvery minnows rescued; Tables 1-2, Figures 1-2). Of the silvery minnows rescued during the 2006 irrigation season, most (an estimated 69,226; 99.05%) were captured in the main channel, while an estimated 663 (0.95%) were captured in the floodplain (Table 2, Figures 1-2). The rate of silvery minnow capture varied from 964/river mile worked in the Isleta Reach, to 577/river mile worked in the Socorro Reach (Table 1). Insufficient portions of the Isleta and San Acacia reaches were sampled during 2006 to determine if the silvery minnow exhibited any discernable patterns of distribution such as was apparent during 2004 and 2005. The number of silvery minnows rescued from main channel habitats progressively increased over time prior to the onset of monsoonal rains during August 2006; thereafter the number of silvery minnows rescued from main channel habitats declined precipitously (Figure 1).

Age I fish (from 2005) represented the most abundant year class. Prior to August and the monsoonal rains, Age 0 (young-of-year) silvery minnows, normally the most abundant year class, were relatively rare in collections. Only after the monsoonal rains were Age 0 silvery minnows large enough to notably enter collections. Even then, their occurrence was patchy.

Recovery of hatchery-produced silvery minnows

Two hatchery-produced silvery minnows were encountered during surveys to locate and rescue silvery minnows from isolated pools that formed as the river receded. These fish were distinguished by a unique visible implant elastomer mark that signified the location, date and size of the fish at the time of stocking. These fish have been introduced into the Rio Grande as a part of an experimental augmentation study being conducted by the Service's Fishery Resources Office. The significance of these observations will be addressed in a separate report for that study. Observations of these collections are presented here for documentation purposes. On April 5, 2006, one silvery minnow, with an orange right dorsal mark, was captured approximately 1.0 mile downstream of the Escondida Drain Outfall (river mile 100.0). On July 21, 2006, one silvery minnow, with a blue left dorsal mark, was captured approximately 2.0 miles downstream of the Los Chavez Wasteway (river mile 154.0).

Documentation of Incidental Take of Silvery Minnows

Incidental take of silvery minnows (larger than 30 mm standard length or approximately 35 mm total length) that occurred as a result of water operations in the Middle Rio Grande was documented and evaluated under limitations established in the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003) and as modified on August 15, 2005 (U. S. Fish and Wildlife Service, 2005a) and June 15, 2006 (U. S. Fish and Wildlife Service, 2006a).

Channel drying resulted in the incidental take of 2,058 silvery minnows (Tables 1 - 3; Figures 4 and 5). An additional 342 silvery minnows failed to recruit to the population as a result of channel drying that occurred during the period May 22 through May 27, 2006 (in violation of the 2003 BO; U. S. Fish and Wildlife Service, 2003 and 2006a). These fish were counted as incidental take attributable to 2006 water operations, bringing the total incidental take for 2006 to 2,400 (Tables 1-3). This level of incidental take was within the limits established in the March 17, 2003 BO (U. S. Fish and Wildlife Service, 2003), as modified on August 15, 2005 (U. S. Fish and Wildlife Service, 2005a) and June 15, 2006 (U. S. Fish and Wildlife Service, 2006a). Of the total amount of incidental take, 411 silvery minnow deaths occurred in the Isleta Reach and the rest (1,647 silvery minnows) occurred in the Socorro Reach (Tables 1-3; Figures 3-4).

The first occurrence of incidental take was observed on April 10, 2006 in the lowermost four mile portion of the Bosque del Apache NWR. The last occurrence of incidental take was on October 24, 2006 (Tables 1-3; Figures 3-4).

Acknowledgments

Agencies and Individuals Assisting in the Rescue of Silvery Minnows During 2006

The Middle Rio Grande Endangered Species Collaborative Program supported this work under Interagency Agreement 02-AA-40-8190 as administered by the Bureau of Reclamation. There were in excess of 100 people that contributed directly to the rescue effort, notably including personnel and contractors associated with the U.S. Fish and Wildlife Service, the U. S. Bureau of Reclamation, and the Army Corps of Engineers. The list of volunteer participants is too extensive to name each individual that participated in this year's silvery minnow rescue operation. However, please know that the contributions of everyone are greatly appreciated. Success in the silvery minnow operation during 2006 can be attributed to the tremendous cooperation and the professionalism of all involved.

Personnel of the New Mexico Ecological Services Field Office of the U. S. Fish and Wildlife Service served to plan and coordinate rescue operations, and represented the core of the rescue workforce, including Nicole Allman, Katherine Barnett, Devin Chappell, Pauletta Dodge, Warren Edaakie, Magdalena Etmadi-Naghani, Jason Everett, Heather Frederick, Joshua Jones, Melissa McAlpine, Lynda Pieyns, Casey Smith, and Michael Hatch. The New Mexico Ecological Services Field Office rescue staff would like to acknowledge the uniquely capable staff of SWCA Ecological Consultants for their assistance with field operations, including: Miguel Barrera, Eric Barker, Sarah Beck, Andy Hawk, KT LaBradie, Bert McAlpine, Patrick McKnight, Matt McMillan, Rachel Thompson, Heather Timmons, Steve Shoup, Jeff Worthington, Carley Welch, and Jeanne Welch. The salvage operation owes much of its success to the strong support from Bureau of Reclamation personnel with field operations, including: Joe Alderete, Mary Chapler, Gary Dean, Charles Fischer, Steven Gonzalez, Chris Groback, Mickey Porter, and Martin Rivera. Likewise, assistance with field operations was provided by Army Corps of Engineers staff, including: Brett Thompson, Tracy Diver, and Don Gallegos. Finally, a special thanks is extended to David Gensler (Middle Rio Grande Conservancy District) and Gregory Pargas (contractor to the Interstate Stream Commission) for their unfaltering assistance with project logistics – assistance that is indispensable to the success of the salvage operation.

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**Tabular Presentations of Results from
Rio Grande Silvery Minnow Rescue Operations – 2006**

**Table 1. Summary of Rio Grande Silvery Minnow Rescue Operations –
2006 (perspective emphasizing longitudinal position)**

Rio Grande Silvery Minnow

Summary of 2006 Rescue Operations

(Perspective Emphasizing Longitudinal Position)

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>RGSM FATES</i>		
				<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
<i>Isleta Reach</i>						
<i>Isleta-Los Lunas Subreach</i>						
<i>Upper Section of the Isleta-Los Lunas Subreach (1.0 River Miles)</i>						
23-Oct-2006	Main Channel	0.25	45 *	0	0	
24-Oct-2006	Main Channel	0.25	50 *	0	1	
25-Oct-2006	Main Channel	0.25	30 *	0	0	
26-Oct-2006	Main Channel	0.25	35 *	0	0	
<i>Descriptive Statistics for the Upper Section of the Isleta-Los Lunas Subreach (1.0 River Miles):</i>						
		<i>Subtotals:</i>	1.00	160	0	1
		<i>Rescued RGSM / River Mile Worked:</i>		160		
<i>Mid-Lower Section of the Isleta-Los Lunas Subreach (6.0 River Miles)</i>						
26-Jul-2006	Main Channel	0.50	500 *	0	0	
<i>Descriptive Statistics for the Mid-Lower Section of the Isleta-Los Lunas Subreach (6.0 River Miles):</i>						
		<i>Subtotals:</i>	0.50	500	0	0
		<i>Rescued RGSM / River Mile Worked:</i>		1,000		

" * " indicates an estimated value.

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>			
			<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
<i>Los Lunas-Belen Subreach</i>						
<i>Upper Section of the Los Lunas-Belen Subreach (6.5 River Miles)</i>						
10-Apr-2006	Main Channel	0.25	200 *	0	0	
18-Jul-2006	Main Channel	4.50	3,500 *	0	18	
21-Jul-2006	Main Channel	1.50	3,000 *	3	351	
22-Jul-2006	Main Channel	1.50	5,000 *	5	30	
26-Jul-2006	Main Channel	3.50	6,500 *	0	0	
19-Sep-2006	Main Channel	3.50	450 *	0	0	
26-Sep-2006	Main Channel	2.50	31	0	0	
03-Oct-2006	Main Channel	2.00	11	0	0	
05-Oct-2006	Main Channel	1.50	175 *	0	0	
<i>Descriptive Statistics for the Upper Section of the Los Lunas-Belen Subreach (6.5 River Miles):</i>						
		<i>Subtotals:</i>	20.75	18,867	8	399
		<i>Rescued RGSM / River Mile Worked:</i>		909		
<i>Lower Section of the Los Lunas-Belen Subreach (4.0 River Miles)</i>						
20-May-2006	Main Channel	0.50	20	0	0	
20-Jul-2006	Main Channel	1.00	4,000 *	5	11	
<i>Descriptive Statistics for the Lower Section of the Los Lunas-Belen Subreach (4.0 River Miles):</i>						
		<i>Subtotals:</i>	1.50	4,020	5	11
		<i>Rescued RGSM / River Mile Worked:</i>		2,680		

" * " indicates an estimated value.

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>			
			<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
<i>Belen-Bernardo Subreach</i>						
<i>Upper Section of the Belen-Bernardo Subreach (9.0 River Miles)</i>						
06-Apr-2006	Main Channel	0.25	120	0	0	
20-May-2006	Main Channel	0.25	480 *	6	0	
<i>Descriptive Statistics for the Upper Section of the Belen-Bernardo Subreach (9.0 River Miles):</i>						
		<i>Subtotals:</i>	0.50	600	6	0
		<i>Rescued RGSM / River Mile Worked:</i>		1,200		
<i>Lower Section of the Belen-Bernardo Subreach (9.0 River Miles)</i>						
20-Apr-2006	Main Channel	0.50	281	0	0	
08-May-2006	Main Channel	0.25	8	0	0	
<i>Descriptive Statistics for the Lower Section of the Belen-Bernardo Subreach (9.0 River Miles):</i>						
		<i>Subtotals:</i>	0.75	289	0	0
		<i>Rescued RGSM / River Mile Worked:</i>		385		

"*" indicates an estimated value.

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>		
			<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
<i>Bernardo-San Acacia Subreach</i>					
<i>Upper Section of the Bernardo-San Acacia Subreach (9.0 River Miles)</i>					
29-Mar-2006	Main Channel	0.25	128	0	0
25-Apr-2006	Main Channel	0.25	23	0	0
<i>Descriptive Statistics for the Upper Section of the Bernardo-San Acacia Subreach (9.0 River Miles):</i>					
		<i>Subtotals:</i>	0.50	151	0
		<i>Rescued RGSM / River Mile Worked:</i>		302	
<i>Descriptive Statistics for the Entire Isleta Reach:</i>					
		<i>Subtotals:</i>	25.50	24,587	19
		<i>Rescued RGSM / River Mile Worked:</i>		964	411

" * " indicates an estimated value.

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>			
			<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
Socorro Reach						
<i>Escondida-Socorro Subreach</i>						
<i>Lower Section of the Escondida-Socorro Subreach (2.5 River Miles)</i>						
05-Apr-2006	Main Channel	0.25	10	2	0	
<hr/>						
<i>Descriptive Statistics for the Lower Section of the Escondida-Socorro Subreach (2.5 River Miles):</i>						
		<i>Subtotals:</i>	0.25	10	2	0
		<i>Rescued RGSM / River Mile Worked:</i>		40		
Socorro-San Antonio Subreach						
<i>Mid-Lower Section of the Socorro-San Antonio Subreach (7.0 River Miles)</i>						
15-Jun-2006	Main Channel	0.25	1	0	0	
16-Jun-2006	Main Channel	0.25	40 *	0	0	
25-Jun-2006	Main Channel	0.50	1,125 *	25 *	172	
26-Jun-2006	Main Channel	2.00	3,000 *	0	307	
02-Oct-2006	Main Channel	1.50	100 *	1	0	
04-Oct-2006	Main Channel	2.00	71	0	0	
07-Oct-2006	Main Channel	0.50	450 *	0	0	
<hr/>						
<i>Descriptive Statistics for the Mid-Lower Section of the Socorro-San Antonio Subreach (7.0 River Miles):</i>						
		<i>Subtotals:</i>	7.00	4,787	26	479
		<i>Rescued RGSM / River Mile Worked:</i>		684		

" * " indicates an estimated value.

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>		
			<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
<i>San Antonio-S. Bndry. Bosque del Apache Subreach</i>					
<i>Upper Section of the San Antonio-S. Bndry. Bosque del Apache Subreach (1.0 River Miles)</i>					
24-Jun-2006	Main Channel	3.00	6,040 *	50 *	428
25-Jun-2006	Main Channel	2.50	3,375 *	38 *	376
01-Oct-2006	Main Channel	3.00	350 *	0	0
02-Oct-2006	Main Channel	0.25	20 *	0	0
04-Oct-2006	Main Channel	2.00	30 *	3	0
<i>Descriptive Statistics for the Upper Section of the San Antonio-S. Bndry. Bosque del Apache Subreach (1.0 River Miles):</i>					
	<i>Subtotals:</i>	10.75	9,815	91	804
	<i>Rescued RGSM / River Mile Worked:</i>		913		

" * " indicates an estimated value.

RGSM FATES

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
<i>Mid-Lower Section of the San Antonio-S. Bndry. Bosque del Apache Subreach (11.5 River Miles)</i>					
10-Apr-2006	Main Channel	1.00	450 *	11	38
21-May-2006	Main Channel	4.50	150 *	2	0
22-May-2006	Main Channel	2.00	720 *	40 *	30
22-May-2006	Main Channel	2.00	1,600 *	20 *	0
23-May-2006	Main Channel	2.00	1,900 *	45 *	8
15-Jun-2006	Main Channel	2.00	4	0	0
15-Jun-2006	Main Channel	0.50	10	0	1
16-Jun-2006	Main Channel	2.00	427	8	3
17-Jun-2006	Main Channel	2.00	545 *	0	76
17-Jun-2006	Main Channel	4.00	4,570 *	0	88
18-Jun-2006	Main Channel	1.50	350 *	0	11
20-Jun-2006	Main Channel	1.50	745 *	0	1
21-Jun-2006	Main Channel	0.25	400 *	60 *	5
21-Jun-2006	Main Channel	4.50	750 *	60 *	0
22-Jun-2006	Main Channel	0.50	2,345 *	180	21
23-Jun-2006	Main Channel	0.50	4,300 *	430 *	77
06-Jul-2006	Main Channel	1.00	500 *	0	5
17-Jul-2006	Floodplain (East Bank)	0.25	13	1	0
19-Jul-2006	Main Channel	1.00	3,000 *	0	0
23-Jul-2006	Main Channel	4.50	2,500 *	0	0
24-Jul-2006	Main Channel	4.00	2,000 *	0	0
25-Jul-2006	Main Channel	2.00	535	0	0
20-Sep-2006	Main Channel	1.50	600 *	0	0
21-Sep-2006	Main Channel	4.00	700 *	0	0

*" * " indicates an estimated value.*

<i>Date</i>	<i>Lateral Position</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>		
			<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
25-Sep-2006	Main Channel	2.00	50	6	0
28-Sep-2006	Main Channel	3.00	76	0	0
29-Sep-2006	Main Channel	6.00	800 *	1	0
12-Oct-2006	Floodplain (West Bank)	0.25	50 *	0	0
30-Oct-2006	Floodplain (West Bank)	0.25	600 *	0	0

Descriptive Statistics for the Mid-Lower Section of the San Antonio-S. Bndry. Bosque del Apache Subreach (11.5 River Miles):

<i>Subtotals:</i>	60.50	30,690	864	364
<i>Rescued RGSM / River Mile Worked:</i>		507		

Descriptive Statistics for the Entire Socorro Reach:

<i>Subtotals:</i>	78.50	45,302	983	1,647
<i>Rescued RGSM / River Mile Worked:</i>		577		

Descriptive Statistics for All Areas:

<i>Grand Totals:</i>	104.00	69,889	1,002	2,058 ***
<i>Percent of Total RGSM Rescued:</i>			1.43	2.94
<i>Rescued RGSM / River Mile Worked:</i>		672		

*** Incidental take (lost reproduction) assigned to channel drying during May 2006 was 342, therefore, total incidental take = 2,400

" * " indicates an estimated value.

**Table 2. Summary of Rio Grande Silvery Minnow
Rescue Operations – 2006
(perspective emphasizing lateral and longitudinal position)**

Rio Grande Silvery Minnow

Summary of 2006 Rescue Operations

(Perspective Emphasizing Lateral and Longitudinal Position)

			<i>RGSM FATES</i>		
<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
<i>Main Channel Habitats</i>					
<i>Isleta Reach</i>					
<i>Isleta-Los Lunas</i>					
26-Jul-2006	0.50	500 *	0	0	
23-Oct-2006	0.25	45 *	0	0	
24-Oct-2006	0.25	50 *	0	1	
25-Oct-2006	0.25	30 *	0	0	
26-Oct-2006	0.25	35 *	0	0	
<i>Subtotals for Main Channel Habitats in the Isleta-Los Lunas Subreach:</i>		1.50	660	0	1

*" * " indicates estimated values.*

<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>RGSM FATES</i>		
			<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
<i>Los Lunas-Belen Subreach</i>					
10-Apr-2006	0.25	200 *	0	0	
20-May-2006	0.50	20	0	0	
18-Jul-2006	4.50	3,500 *	0	18	
20-Jul-2006	1.00	4,000 *	5	11	
21-Jul-2006	1.50	3,000 *	3	351	
22-Jul-2006	1.50	5,000 *	5	30	
26-Jul-2006	3.50	6,500 *	0	0	
19-Sep-2006	3.50	450 *	0	0	
26-Sep-2006	2.50	31	0	0	
03-Oct-2006	2.00	11	0	0	
05-Oct-2006	1.50	175 *	0	0	
<i>Subtotals for Main Channel Habitats in the Los Lunas-Belen Subreach:</i>		22.25	22,887	13	410
<i>Belen-Bernardo Subreach</i>					
06-Apr-2006	0.25	120	0	0	
20-Apr-2006	0.50	281	0	0	
08-May-2006	0.25	8	0	0	
20-May-2006	0.25	480 *	6	0	
<i>Subtotals for Main Channel Habitats in the Belen-Bernardo Subreach:</i>		1.25	889	6	0

" * " indicates estimated values.

		<i>RGSM FATES</i>			
	<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
<i>Bernardo-San Acacia Subreach</i>					
	29-Mar-2006	0.25	128	0	0
	25-Apr-2006	0.25	23	0	0
<i>Subtotals for Main Channel Habitats in the Bernardo-San Acacia Subreach:</i>		0.50	151	0	0
<i>Subtotals for Main Channel Habitats in the Isleta Reach:</i>		25.50	24,587	19	411

*" * " indicates estimated values.*

			<i>RGSM FATES</i>			
<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>		
<i>Socorro Reach</i>						
<i>Escondida-Socorro Subreach</i>						
05-Apr-2006	0.25	10	2	0		
<i>Subtotals for Main Channel Habitats in the Escondida-Socorro Subreach:</i>		0.25	10	2	0	
<i>Socorro-San Antonio Subreach</i>						
15-Jun-2006	0.25	1	0	0		
16-Jun-2006	0.25	40 *	0	0		
25-Jun-2006	0.50	1,125 *	25 *	172		
26-Jun-2006	2.00	3,000 *	0	307		
02-Oct-2006	1.50	100 *	1	0		
04-Oct-2006	2.00	71	0	0		
07-Oct-2006	0.50	450 *	0	0		
<i>Subtotals for Main Channel Habitats in the Socorro-San Antonio Subreach:</i>		7.00	4,787	26	479	

" * " indicates estimated values.

RGSM FATES

<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
<i>San Antonio-S. Bndry.</i>				
<i>Bosque del Apache Subreach</i>				
10-Apr-2006	1.00	450 *	11	38
21-May-2006	4.50	150 *	2	0
22-May-2006	2.00	1,600 *	20 *	0
22-May-2006	2.00	720 *	40 *	30
23-May-2006	2.00	1,900 *	45 *	8
15-Jun-2006	0.50	10	0	1
15-Jun-2006	2.00	4	0	0
16-Jun-2006	2.00	427	8	3
17-Jun-2006	2.00	545 *	0	76
17-Jun-2006	4.00	4,570 *	0	88
18-Jun-2006	1.50	350 *	0	11
20-Jun-2006	1.50	745 *	0	1
21-Jun-2006	4.50	750 *	60 *	0
21-Jun-2006	0.25	400 *	60 *	5
22-Jun-2006	0.50	2,345 *	180	21
23-Jun-2006	0.50	4,300 *	430 *	77
24-Jun-2006	3.00	6,040 *	50 *	428
25-Jun-2006	2.50	3,375 *	38 *	376
06-Jul-2006	1.00	500 *	0	5
19-Jul-2006	1.00	3,000 *	0	0
23-Jul-2006	4.50	2,500 *	0	0
24-Jul-2006	4.00	2,000 *	0	0
25-Jul-2006	2.00	535	0	0
20-Sep-2006	1.50	600 *	0	0

*" * " indicates estimated values.*

<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>RGSM FATES</i>			
		<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>	
21-Sep-2006	4.00	700 *	0	0	
25-Sep-2006	2.00	50	6	0	
28-Sep-2006	3.00	76	0	0	
29-Sep-2006	6.00	800 *	1	0	
01-Oct-2006	3.00	350 *	0	0	
02-Oct-2006	0.25	20 *	0	0	
04-Oct-2006	2.00	30 *	3	0	
<i>Subtotals for Main Channel Habitats in the San Antonio-S. Bndry. Bosque del Apache Subreach:</i>		70.50	39,842	954	1,168
<i>Subtotals for Main Channel Habitats in the Socorro Reach:</i>		77.75	44,639	982	1,647
<i>Totals for all Main Channel Habitats:</i>		103.25	69,226	1,001	2,058

" * " indicates estimated values.

		<i>RGSM FATES</i>			
	<i>Date</i>	<i>Distance Worked (Riv. Mi.)</i>	<i>Rescued</i>	<i>Transport Loss</i>	<i>Main Channel Mortality (Incidental Take)</i>
<i>Floodplain Habitats</i>					
<i>Socorro Reach</i>					
<i>San Antonio-S. Bndry.</i>					
<i>Bosque del Apache Subreach</i>					
	17-Jul-2006	0.25	13	1	0
	12-Oct-2006	0.25	50 *	0	0
	30-Oct-2006	0.25	600 *	0	0
<i>Subtotals for Floodplain Habitats in the San Antonio-S. Bndry. Bosque del Apache Subreach:</i>		0.75	663	1	0
<i>Subtotals for Floodplain Habitats in the Socorro Reach:</i>		0.75	663	1	0
<i>Totals for all Floodplain Habitats:</i>		0.75	663	1	0
<i>Grand Totals:</i>		104.00	69,889	1,002	2,058***

*** Incidental take (lost reproduction) assigned to channel drying during May 2006 was 342, therefore total incidental take = 2,400

" * " indicates estimated values.

Table 3. Summary of Rio Grande Silvery Minnow Incidental Take – 2006

Rio Grande Silvery Minnow

Summary of 2006 Incidental Take

<i>Date</i>	<i>Reach</i>	<i>Range of River Miles Worked</i>		<i>Main Channel Mortality (Incidental Take)</i>	<i>Incidental Take Running Sum</i>	
		<i>Upstream</i>	<i>Downstream</i>		<i>Over Time</i>	<i>Percent of Total</i>
10-Apr-2006	Socorro	79	78	38	38	1.8
22-May-2006	Socorro	76.5	74.5	30	68	3.3
23-May-2006	Socorro	76.5	74.5	8	76	3.7
15-Jun-2006	Socorro	84	83.5	1	77	3.7
16-Jun-2006	Socorro	76	74	3	80	3.9
17-Jun-2006	Socorro	81.5	77.5	88	168	8.2
17-Jun-2006	Socorro	76	74	76	244	11.9
18-Jun-2006	Socorro	77.5	76	11	255	12.4
20-Jun-2006	Socorro	82.5	81	1	256	12.4
21-Jun-2006	Socorro	82.5	82.5	5	261	12.7
22-Jun-2006	Socorro	83	82.5	21	282	13.7
23-Jun-2006	Socorro	84	83.5	77	359	17.4
24-Jun-2006	Socorro	87	84	428	787	38.2
25-Jun-2006	Socorro	87	84.5	376	1163	56.5
25-Jun-2006	Socorro	88	87.5	172	1335	64.9
26-Jun-2006	Socorro	90.5	88.5	307	1642	79.8
06-Jul-2006	Socorro	79.5	78.5	5	1647	80.0
18-Jul-2006	Isleta	157	152.5	18	1665	80.9
20-Jul-2006	Isleta	154	153	11	1676	81.4
21-Jul-2006	Isleta	154.5	153	351	2027	98.5
22-Jul-2006	Isleta	157.5	156	30	2057	100.0
24-Oct-2006	Isleta	Omitted	Omitted	1	2058	100.0

Incidental take (lost reproduction) assigned to channel drying during May 2006 = 342

Total incidental take = 2,400

**Graphic Depictions of Results from
Rio Grande Silvery Minnow Rescue Operations – 2006**

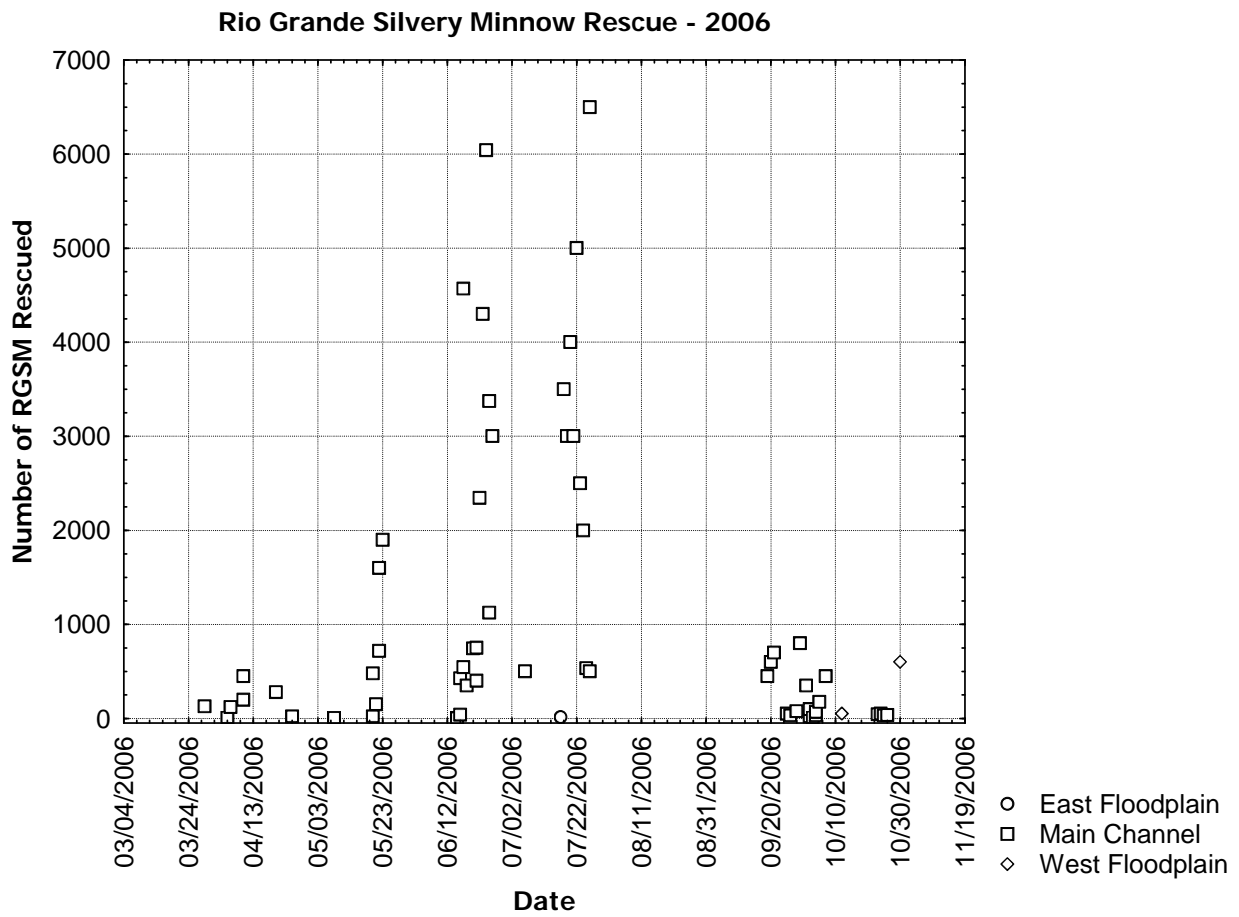


Figure 1. Date and lateral distribution of the estimated number of Rio Grande silvery minnows rescued during 2006.

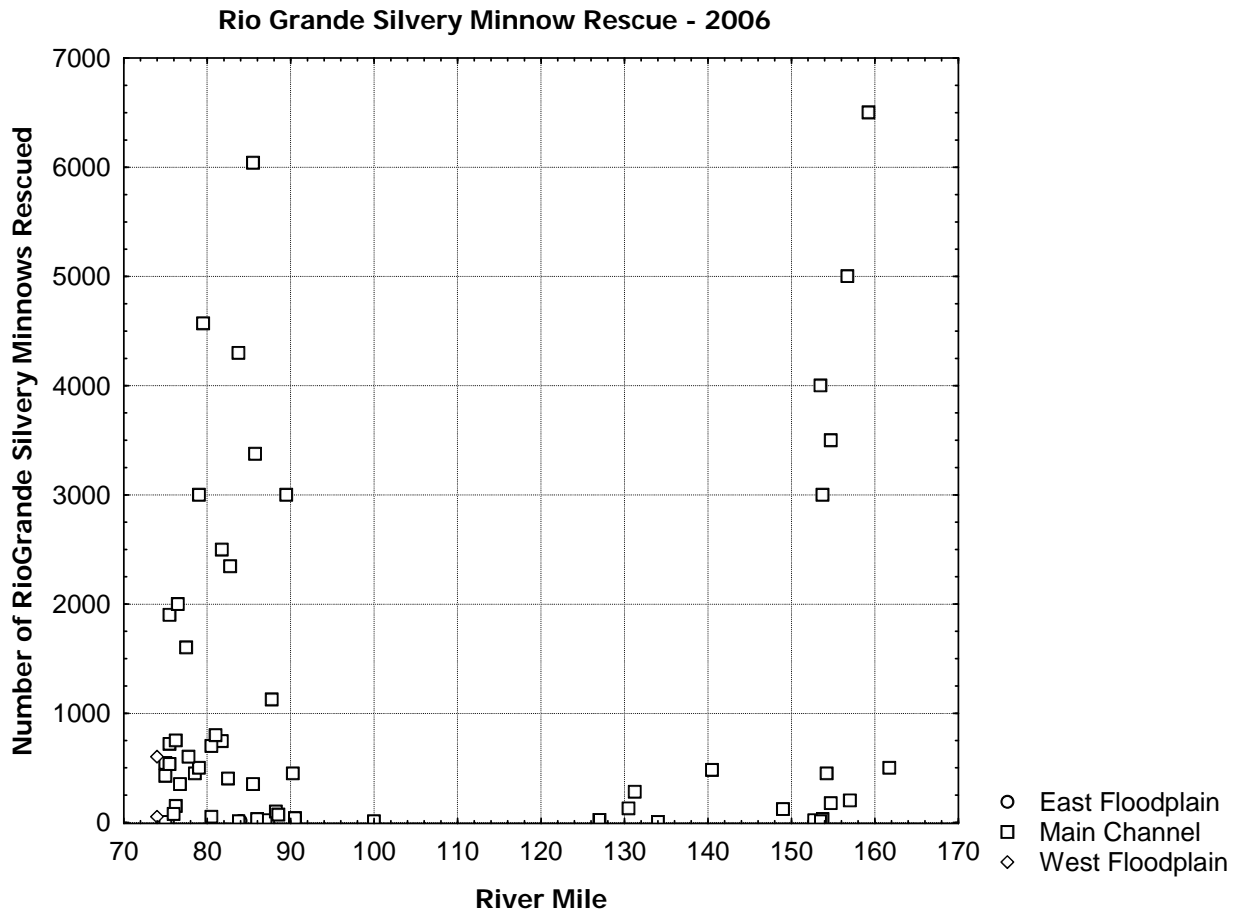


Figure 2. Longitudinal and lateral distribution of the estimated number of Rio Grande silvery minnows rescued during 2006. Collections on Indian Pueblo lands are excluded. Rough landmark approximations to river mile include: Los Lunas – 161.5, Belen – 149.5, San Acacia – 116.0, San Antonio – 87.0, San Marcial – 68.5, and Fort Craig – 64.5.

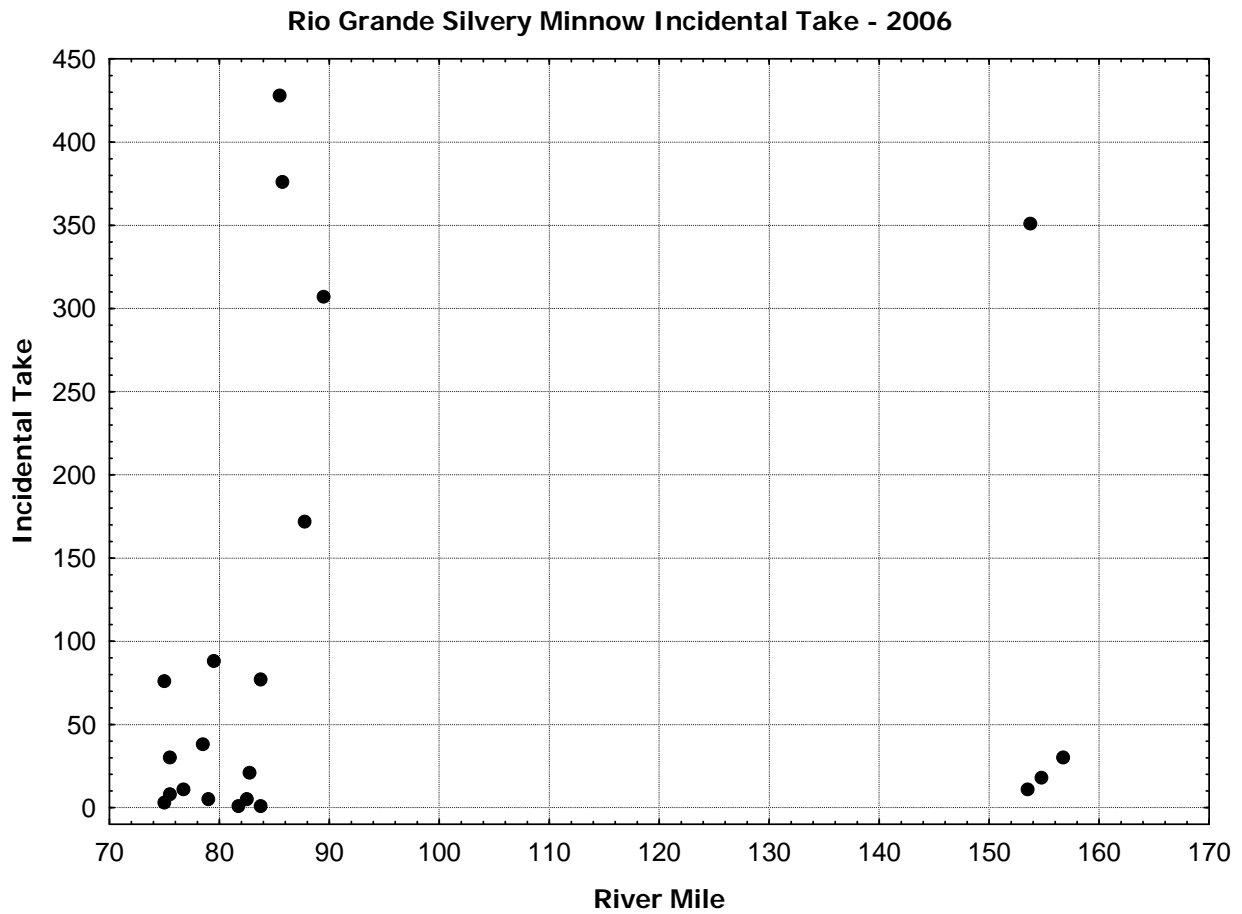


Figure 3. Longitudinal distribution of Rio Grande silvery minnow incidental take during 2006. Collections on Indian Pueblo lands are excluded. Rough landmark approximations to river mile include: Los Lunas – 161.5, Belen – 149.5, San Acacia – 116.0, San Antonio – 87.0, San Marcial – 68.5, and Fort Craig – 64.5.

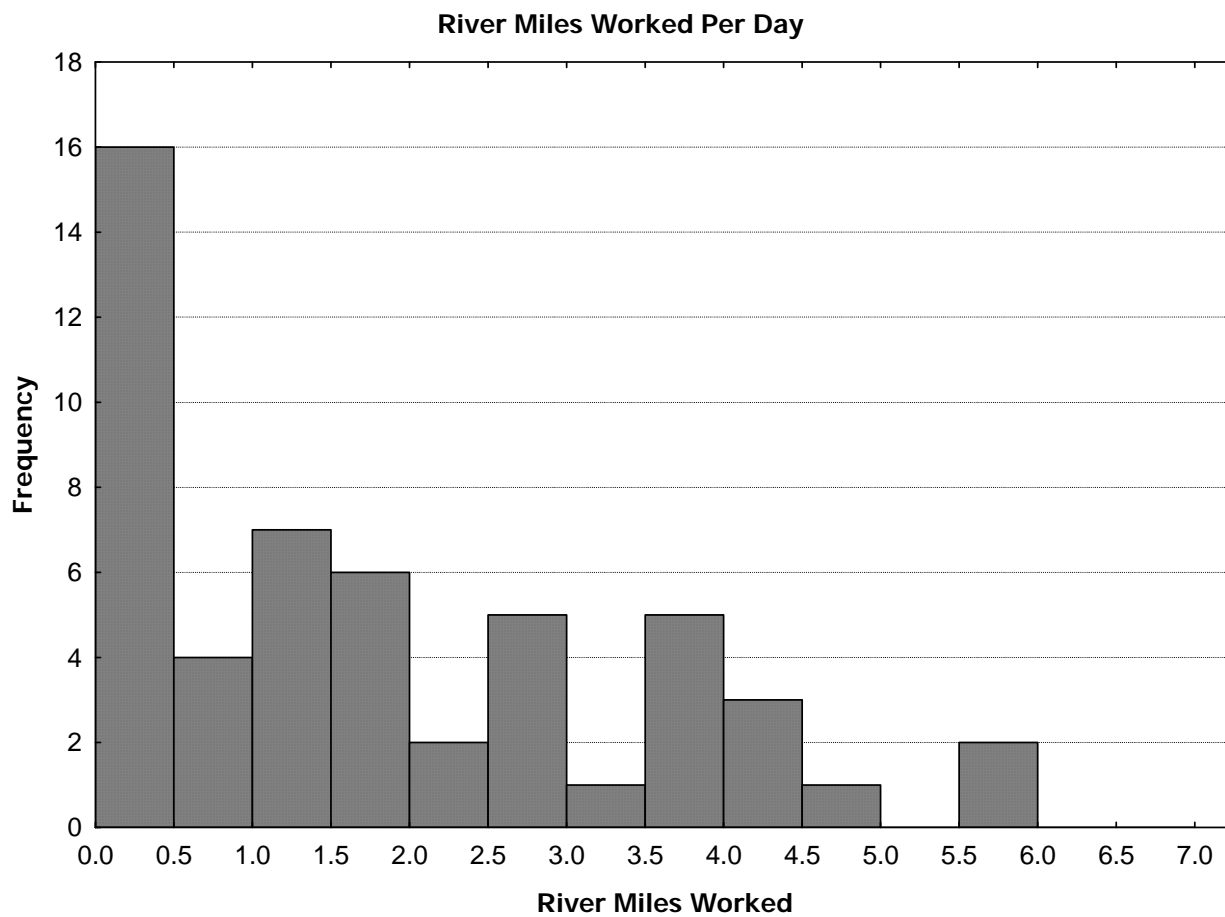


Figure 5. Histogram of river miles worked per reach, per day during 2006.

Appendix A.
Rio Grande Silvery Minnow Rescue – Daily Field Form

2006

RGSM Rescue – Daily Field Form

Date: _____

Personnel: _____

Start Time: _____ End Time: _____

River Mile Upstream: _____

River Mile Downstream: _____

Stock Location:

Bernalillo Alameda I-40 Central Rio Bravo

Other _____

Age Class Distribution (Percent)				
Age 0 (0-45 SL)	Age I (46-62 SL)	Age II (63-70 SL)	Age III (71-76 SL)	Age IV (77-82 SL)

Marked Fish			
River Mile	Mark Color	Mark Location	Fish Condition

* indicates an estimate

RGSM Rescued: _____

RGSM Transport Loss: _____

RGSM Incidental Take: _____

Other RGSM Mortality: _____

Habitat: E-Floodplain W-Floodplain Main Channel

GPS Coordinates (NAD 83):

US Easting: _____ US Northing: _____

DS Easting: _____ DS Northing: _____

Comments: _____

Pueblo: Y or N

2006

Daily Fish Community Collection Field Form

Date: _____

Personnel: _____

River Mile Upstream: _____ River Mile Downstream: _____

FAMILY	SPECIES	COMMON NAME	Age (Adult – YOY – Mix)	Abundance (C - Common, R – rare)
CATOSTOMIDAE	<i>Carpiodes carpio</i>	river carpsucker		
	<i>Catostomus (Catostomus) commersonii</i>	white sucker		
	<i>Ictiobus bubalus</i>	smallmouth buffalo		
CENTRARCHIDAE	<i>Lepomis (Chaenobryttus) cyanellus</i>	green sunfish		
	<i>Lepomis (Lepomis) macrochirus</i>	bluegill		
	<i>Micropterus punctulatus</i>	spotted bass		
	<i>Micropterus salmoides salmoides</i>	largemouth bass		
	<i>Pomoxis annularis</i>	white crappie		
	<i>Pomoxis nigromaculatus</i>	black crappie		
CLUPEIDAE	<i>Dorosoma cepedianum</i>	gizzard shad		
CYPRINIDAE	<i>Carassius auratus</i>	goldfish		
	<i>Cyprinella lutrensis</i>	red shiner		
	<i>Cyprinus carpio</i>	common carp		
	<i>Hybognathus amarus</i>	Rio Grande silvery minnow		
	<i>Notemigonus crysoleucas</i>	golden shiner		
	<i>Pimephales promelas</i>	fathead minnow		
	<i>Pimephales vigilax</i>	bullhead minnow		
	<i>Platygobio gracilis</i>	flathead chub		
ICTALURIDAE	<i>Rhinichthys cataractae</i>	longnose dace		
	<i>Ameiurus melas</i>	black bullhead		
	<i>Ameiurus natalis</i>	yellow bullhead		
	<i>Ictalurus punctatus</i>	channel catfish		
	<i>Ictalurus furcatus</i>	blue catfish		
PERCICHTHYIDAE	<i>Pylodictis olivaris</i>	flathead catfish		
PERCIDAE	<i>Morone chrysops</i>	white bass		
	<i>Perca flavescens</i>	yellow perch		
POECILIIDAE	<i>Sander vitreum</i>	walleye		
	<i>Gambusia affinis</i>	western mosquitofish		